ARMY RESEARCH LABORATORY

Contract Req
Software Development Plan
Version 1.0: A C-BASS Component

by Denis McGurin

ARL-MR-452 July 1999

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Denis McGurin
Corporate Information and Computing Directorate, ARL

Abstract

This document is the first in a series of reports that make up the technical documentation library for Contract Request (Req) Version 1.0. Contract Req is a component of the Corporate Business Application Software System (C-BASS) suite of applications, an integrated family of Lotus Notes and Web-based software for U.S. Army Research Laboratory (ARL) electronic workflow and task automation. The purpose of Contact Req is to automate a portion of the ARL contracting process. This report contains five major segments: (1) Problem Statement, (2) Technical Approach, (3) Project Management Approach, (4) Product Assurance, and (5) Project Schedule. Together, these sections give an overview of Contract Req's purpose, identify organizational requirements and constraints, develop a management plan, and set forth a timetable with major milestones.

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1. Introduction

This report presents the development plan for Contract Requirements Version 1.0 (hereafter referred to as Contract Req). This prototype will be used at all U.S. Army Research Laboratory (ARL) sites. Additionally, the exercise forms the nucleus of an automated contract requisition system for future use at all ARL sites as a full production system.

Contract Req is a component of the Corporate Business Application Software System (C-BASS) cluster of applications, an integrated family of Lotus Notes and Web-based software to support ARL electronic workflow and task automation. This suite of applications interfaces with standard Department of Defense (DOD) systems to provide functionality unique to research and development (R&D) competencies. Primary responsibility for the development of C-BASS resides with the Corporate Information and Computing Center (CICC), Enterprise Systems Division (ESD).

1.1 Purpose. The purpose of Contract Req is to model experimentally a secure client/server system that will automate the preparation of the Contract Req package. The prototype approach mitigates risk by resolving unknowns related to new technologies being used to build the ARL Intranet architecture and to refine further previously specified user requirements.

More specifically, Contract Req automates the capture of information necessary for three significant, official documents in the procurement process: (1) Form DA 3953, Purchase Request and Commitment, (2) the Statement of Work (SOW), and (3) the Government Cost Estimate [1]. Essentially, Contract Req automates the Procurement Data Package (PDP) that must be prepared in the early stages of the procurement cycle. Figure 1 shows where these items fit into the total contract life cycle.

1.2 Background. Initiation of the multiple components of the C-BASS effort is motivated by several factors. For example, ARL as a whole continues to undergo a reduction-in-force, with downsizing of Chief of Staff (COS) organizations expected to be proportionally greater than other

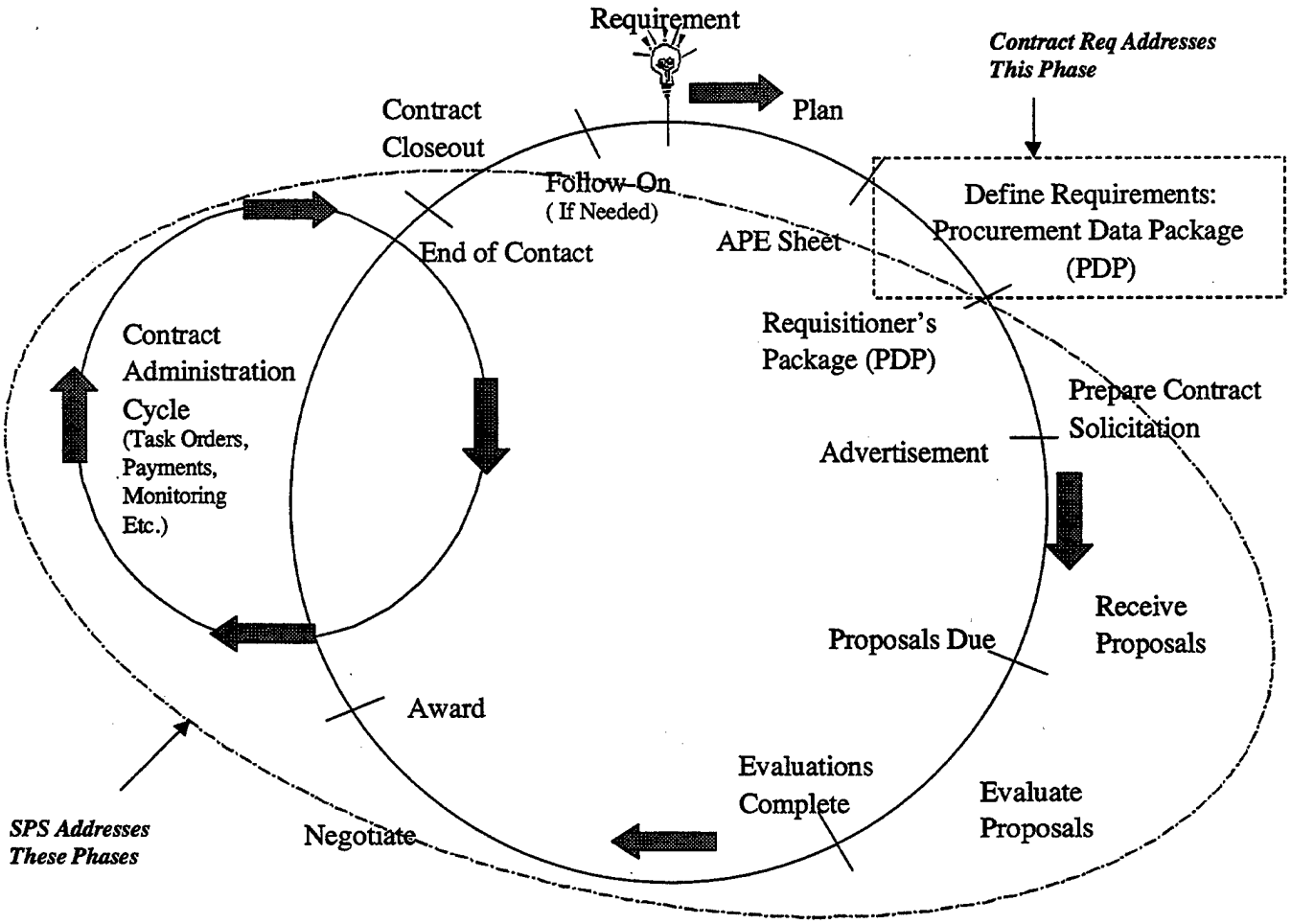

Figure 1. The Contract Life Cycle.

areas of ARL. However, automation tools such as Contract Req are expected to lessen the effects of the loss of people by allowing for the coordination of work regardless of geography, time zones, and work schedules.

Important preparations for increased automation of ARL business practices precede the C-BASS effort. Specifically, the need to disseminate contract information to requisitioners and managers has been identified in studies going back to 1976 at the Adelphi Laboratory Center (ALC) and to 1986 as a multisite, corporate requirement. Notably, a business process reengineering (BPR) initiative defined a "To Be" model for the formal contracts process for all

ARL sites [2]. This BPR "To Be" model serves as a foundational reference for the processes defined in the Contract Req automation effort. Intended as a preliminary study rather than a working design document, the BPR "To Be" model lacks complete detail for process automation and does not fully describe requisitioners' needs. Therefore, further analysis is necessary in areas selected for automation projects by CICC's ESD.

When completed, Contract Req implements a secure ARL-wide client/server system that allows users to:

- Enter a contract request electronically,
- Attach the SOW and Cost Estimate to the contract request,
- Route the request to the necessary functional users for electronic approval,
- Automate interfaces to existing, standard legacy systems, and
- Provide tracking, reporting, and request status.

Contract Req will conform to the ESD life-cycle strategy for ARL Intranet application development. The project will proceed in phases, using an incremental, evolutionary approach.

1.3 Organizational Responsibilities. CICC's ESD has the responsibility to develop the Contract Req plan and system for all ARL sites. The Acting Chief of ESD is Dr. Dana Ulery.

1.3.1 Personnel Requirements. The prototype project team requires personnel from ESD, the Systems Operations Branch (SOB), COS Procurement, other COS organizations (e.g., Financial Systems), and contractors to provide technical support. Table 1 suggests the project personnel and their responsibilities.

1.3.2 Interfacing Groups. The Contract Req project requires collaboration between ESD personnel, COS Contracts Office personnel, COS automation points of contact (POCs), SOB personnel, Standard Army Automated Contract System (SAACONS) project office personnel, and Standard Procurement System (SPS) project office personnel. Table 2 lists the interface groups and the roles they play relative to this project.

Table 1. Project Personnel

Name	Organization	Percent of Work Time Committed to Project	Responsibilities
Denis McGurin	ESD	80	Project Manager, Project Planning, Analysis, Development, Testing, Documentation
John Leopard	ESD	90 (While available)	Analysis, Development, Testing, Documentation
Mark Winsor	ProVar (Contractor)	50	Analysis, Development, Testing, Documentation
Robert Rosen	CICC	2	Requisitioner Requirements
Barry Lerman	COS	2	Overall COS Requirements
Catherine Delancy	COS Procurement	5	Main POC in Procurement
Robert Tomko	COS Procurement	2	Overall Procurement Requirements and Testing
Mary Ellen Caldwell	COS Competition Advocate	2	User Requirements
Joan LoPresti	COS Procurement	2	User Requirements - Contracts
Debbie Baggett	COS Procurement	2	User Requirements - Purchasing Office
Jill Ortwein	COS Procurement	2	User Requirements and Information Systems Environment Information

1.4 Current and Future Automation in the Contracts Arena. Considerable automation that supports formal contracts in the Government sector currently exists. Additionally, automation projects are underway at the DOD level that will provide additional, near-future systems. All viable existing systems must be taken into account during the design and development of Contract Req.

Any automated system currently in production use within the information environment is termed a "legacy system." This includes those developed by ARL, commercial-off-the-shelf (COTS) software purchased for use by the organization, and Government-off-the-shelf (GOTS)

Table 2. Interfacing Groups

Group	Organization	Roles
Requisitioners	Directorates, COS, CICC	Provide Requirements to Contracts Require Status Information From Contracts
Systems Maintainers	SOB	Knowledge of the Business Automation Systems Environment for Systems Currently Supporting the Contracts Function, Turnover Criteria, Assessment and Evaluation for Contract Req Products. Provide Ongoing Maintenance When Contract Req Versions Move From Development to Production
Systems Developers	ESD, SOB, COS Contracts	Creation of Automation Tools Supporting the Formal Contracting Function
Business Analysts	COS	Procurement, Budget, and Logistics Data Inputs, Information Requirements, and Process Knowledge
SOMARDS Analysts	COS	Interface to Standard Operations and Maintenance Army Research Development System (SOMARDS)
SAACONS/SPS Analysts	COS	Interface to SAACONS and SPS
CICC Advisory Council (CAC)	Directorates, COS, CICC	Strategic Direction, Alignment to Business Direction

software provided by external government agencies. As soon as any automated system moves from development and experimental use to full production and maintenance, it becomes a legacy system. Designs for Contracts Req take into account two categories of legacy systems: in-house and external.

(1) In-House Legacy System - Any system developed by ARL or a predecessor organization that is currently in production use at any ARL site. Several ARL in-house legacy systems support the contract life cycle:

- The Acquisition Plan of Execution (APE) system is a Model 204 (M204) database of information about planned contractual actions.
- The CONTRAC system principally contains milestones of contract development; it uses the System 2000 (S2K) database management system (DBMS).
- The Request for Proposal (RFP) system assists contract specialists in building the contract document.

(2) External Legacy System - Any system acquired from an external source (COTS or GOTS) that is currently in production use at any ARL site. In some cases, the use of GOTS systems is mandated by higher headquarters.

- SAACONS is a Department of the Army (DA) standard system that most Army installations use. SAACONS functionality has been extended since its first fielding, and it could be further enhanced to handle more of the functions of contract preparation. Since ARL uses a more extensive set of functions and controls than those covered in the SAACONS, the use of SAACONS at ARL in formal contracts is limited.

In addition to current legacy systems, future DOD or DA advancements in contract automation must be taken into consideration—especially those systems that are likely to become a part of ARL's production information environment. This includes systems in development by ARL, COTS systems for which an acquisition has been initiated, and GOTS systems known to be mandated and to be installed in the foreseeable future.

Of note are plans for the DOD's Standard Procurement System (SPS), which will replace SAACONS as the DA standard procurement system. Information about SPS is incomplete, but the system is reputed to provide even more capability than SAACONS. Other in-house system improvements and updating are also underway. For example, ARL Contracts Branch is rewriting the CONTRAC system using the Microsoft Access DBMS. Work is now under way on this project. Ms. Jill Ortwein is the POC.

2. Problem Statement

Contract Req provides an information system that assists requisitioners and procurement personnel to process large acquisitions in a timely, efficient, and accountable manner. As noted in the preceding section, existing and future legacy systems provide substantial assistance within the confines of the procurement function.

Referring back to Figure 1, Contract Req addresses the portion of the life cycle noted as "Procurement Data Package" (PDP) within the dashed box. The key strategic requirements for the prototype are to provide three basic automated functionalities:

(1) To develop the three requirements documents of the Procurement Data Package (PDP),
(2) To route these PDP documents to ARL entities that must approve the acquisition, and
(3) To route the approved PDP to Procurement.

Future versions of Contract Req will extend the basic capability within this portion of the life cycle and undertake projects addressing other phases of the life cycle.

Development of Contract Req Version 1.0 for full production use will be based on an evolutionary development approach that uses the Zachman [3] architectural framework and an iterative, incremental life cycle model.

Four steps—each characterized by specific activities and the products produced by those activities—will be used to develop the prototype:

(1) Software Requirements Analysis,
(2) Design Analysis,
(3) Implementation, and
(4) System Testing.

Deliverables include

(1) Software,
(2) Structured specifications document,
(3) Testing plan, and
(4) User information sheet.

Intermediate software components produced to demonstrate specific functions will include

(1) Capability to attach large text files to the DA 3953 data,
(2) Routing of the whole Procurement Data Package (PDP) to approvers, and
(3) Capability to perform these functions in Lotus Notes and Intranet environments.

The design documents for Contract Req will provide precise, detailed technical models and processes, rather than ambiguous English language descriptive text. They will be appropriately brief and, like the prototype software, form the nucleus for full system documentation [4].

3. Technical Approach

In accordance with standard software engineering practices [5], critical decisions about the technical approach to Contract Req development are driven by (1) life cycle considerations, (2) constraints, (3) anticipated or unresolved problems, (4) development environment, and (5) methodologies and development tools.

3.1 Life Cycle Strategy. The life cycle approach being used stresses four principles:

(1) An architectural framework that explicitly defines critical system components from multiple perspectives and the relationships among these components, in order to ensure integration of the business, operational, and computing models [6];

(2) Use of COTS products wherever possible to reduce costs and improve reliability and productivity;

(3) Evolutionary, iterative steps to incrementally build multiple, shorter-cycle products and to control risk [7]; and

(4) Reuse of existing software whenever possible to shorten the development cycle and increase quality by using previously proven components [8].

Contract Req Version 1.0 is the first phase in the life cycle of the full production product.

3.2 Constraints. Some central constraints are shown in Table 3. All elements in the development process have been considered in order to develop a realistic software design plan; however, the following list is not all-inclusive.

Table 3. Constraints

Constraint	Explanation
Incomplete analysis in the BPR "To Be" model	This model provides a general level of process description and flow. The software developed in Version 1.0 will rely on functional documentation, examples, and input from experts, as well as the general model.
Unclassified research and development (R&D) services contract focus	The user will be able to develop packages for unclassified services contracts, which represent a large share of the formal contracts and thus provide the best benefit to requisitioners, contracts, and the mission of ARL.

3.3 Anticipated or Unresolved Problems. Table 4 lists some of the anticipated and unresolved problems that could affect development and delivery.

3.4 Development Environment. The development environment consists of the following:

- Hardware
  - Server: PC, dual 133-MHz Pentium processors, 96 MB RAM, (two) 4.5-GB hard drives, 4X CD-ROM, 4-GB 4-mm tape drive, Ethernet connection.
  - Client: PC no lower than 486, Pentium preferred.

Table 4. Anticipated and Unresolved Problems

Problem	Explanation and Mitigation
Project manpower	The project is designed to have a core team of three developers. Availability of manpower may delay project completion or limit functionality.
End of fiscal year	The rush to spend funds before the funds expire at the end of the fiscal year on October 1 may make procurement resources unavailable to project personnel and delay work at that time.

•Software

- Server: Microsoft Windows NT Server 4.0, Lotus Notes Server 4.5.
- Client: Microsoft Windows 95 or NT Workstation 4.0, Lotus Notes Desktop 4.5.
- Middleware to interface to legacy systems reusing BuyIt middleware or modeled on the BuyIt middleware [9].

3.5 Activities, Tools, and Products. Table 5 lists the major activities and methodologies/tools to be used, as well as the products of each phase of the development cycle.

4. Project Management Approach

Cost, schedule, and performance will be closely tracked to determine the progress of the proposed work [10]. *Cost* in this project is the person-hours of government employees and the person-hours of contractor effort. An associated cost (but one not borne by ESD) is the cost in user areas to implement Lotus Notes. Based on current guidelines, a *schedule* for Contract Req has been developed and is given in Appendix A. *Performance* is under the control of ESD and the Contract Req project manager, as long as functions being developed by the DOD Standard Procurement System (SPS) are avoided. ESD balances its projects across the three dimensions of cost, schedule, and performance. Since the first two are constrained, the only flexibility is in the functionality provided in the first release.

Table 5. Major Activities, Methodology/Tools, and Products

Activity	Methodology/Tools	Products
Software Requirements Analysis	Structured Analysis [4, 6–8]	• Data Flow Model • Data Model • Structured Specifications
Design Analysis	Structured Design [6–8]	• System Interfaces • Forms Design • Navigator Design • Structure Charts
Development and Implementation	Lotus Notes application development [10–11]	• Routing and Tracking Function • Links to Other Systems • Reports • Database Creation • Forms Creation
System Testing	• Software Engineering testing methods and tools • Configuration Management	• Prototype test plan • Inspection summaries • Test logs • Discrepancy reports • Configuration management controls

4.1 Assumptions and Constraints. Two major considerations (multiple task assignments for key team members and minimal experience with Lotus Notes) combine to maximize the software engineering complexity rating for this project. When compared to optimal project conditions, the marginally adequate resource allocation and the low level of expertise increase the uncertainty of effort estimate by a factor of greater than 2.

Most members of the proposed project team have some experience with Lotus Notes applications. However, their experience with application development and system administration averages less than 2 years. This circumstance is reflected in the projected schedule of activities and milestones.

Additional factors of resource scheduling also impact the development timeline given as the Appendix in this report. The Contract Req prototype competes with other high-priority tasks

associated with establishing the ARL Intranet, such as the full production version of BuyIt (the first in the C-BASS suite of applications).

4.2 Resource Requirements. Estimates of the distribution of time and effort over the phases of the project are listed in Table 6.

Table 6. Estimated Distribution of Time and Effort

Phase	Time (Percent)	Effort (Percent)
Requirements Analysis	20	15
Design Analysis	20	20
Development and Implementation	40	45
System Testing	15	15
User Implementation	5	5

4.3 Milestones and Schedules. Appendix A gives the detailed schedule for this project, showing work breakdowns, task duration, start and end dates, task dependencies, and milestones (based on the received guidance for the project start). Significant milestones include

- Completing software requirements analysis,
- Defining system architecture, data description, user interface, and processing actions,
- Implementing software designs and link to legacy system,
- Bench-testing and field-testing the prototype, and
- System production implementation at major ARL sites.

4.4 Metrics. Metrics will be used to monitor and manage progress and product quality. Both objective and subjective data will be gathered to develop and maintain a picture of project progress and health. Key project metrics and their uses are listed in Table 7.

4.5 Project Risk Management. An Information Technology (IT) project's risk is influenced by three factors: project size, familiarity with the technology, and structure of the project [11]. *Project size* risk refers to the size of the project relative to the experience of the project team on

Table 7. Key Project Metrics

Metric	Frequency	Use
Development task status	Weekly	• Progress measurement • Process control • Design stability
Change management in specifications and design	Biweekly, or as needed depending on impact	• Quality of specifications • Quality of design • Identify problems • Identify need to reiterate a previous phase
Software size estimates	Biweekly	• Measure progress • Monitor quality of process and design
Tests	Weekly	• Monitor progress • Monitor quality of process and design

other projects. *Familiarity with the technology* refers to the team's experience with the particular technologies to be used on the project. *Structure of the project* refers to the control of scope, performance, and the amount of formal project management structure used in the project. Table 8 more fully describes the risks associated with Contract Req Version 1.

Table 8. Project Risk Analysis

Factor	Explanation and Mitigation
Project Size	The project is to be implemented for ARL-wide use. ESD experience in projects with multiple-site use is low.
Familiarity with the Technology	ESD has less than 2 years of experience with Lotus Notes.
Project Structure	ESD controls project scope, but not schedule, since completion date is directed. Project management structure will be high in order to manage progress and prevent scope creep.

The primary tool for managing risk is the use of disciplined software engineering approaches and methods. As mentioned in section 4.1, the use of multiple new technologies coupled with inexperienced staff subjects this project to risk. However, the detailed technical models being

developed in all phases of the Contract Req project provide a basis for assessing technical risk. Potentially high-risk conditions, whether technical or nontechnical, will be identified promptly and brought to the attention of management responsible for decisions regarding project resources and timing.

5. Product Assurance

Within any software engineering project, quality assurance activities are integrated throughout the development process.

5.1 Assumptions and Constraints. The Contract Req Version 1 product will be put into immediate production use at multiple sites. Rigorous testing is required.

5.2 Quality Assurance. Weekly management reviews will be held with CICC and COS. Direct interaction with customer representatives identified earlier will assure continued tracking of the project.

5.3 Configuration Management. The ESD-developed configuration management methodology will be employed in this project. Table 9 lists the products that will be under configuration management control.

Table 9. Products Under CM Control

Product
Software
Software Development Plan
Software Requirements Analysis Document
Data Flow Model
Data Model
Design Document
Test Plan
Test Reports

6. References

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Appendix:

Project Schedule

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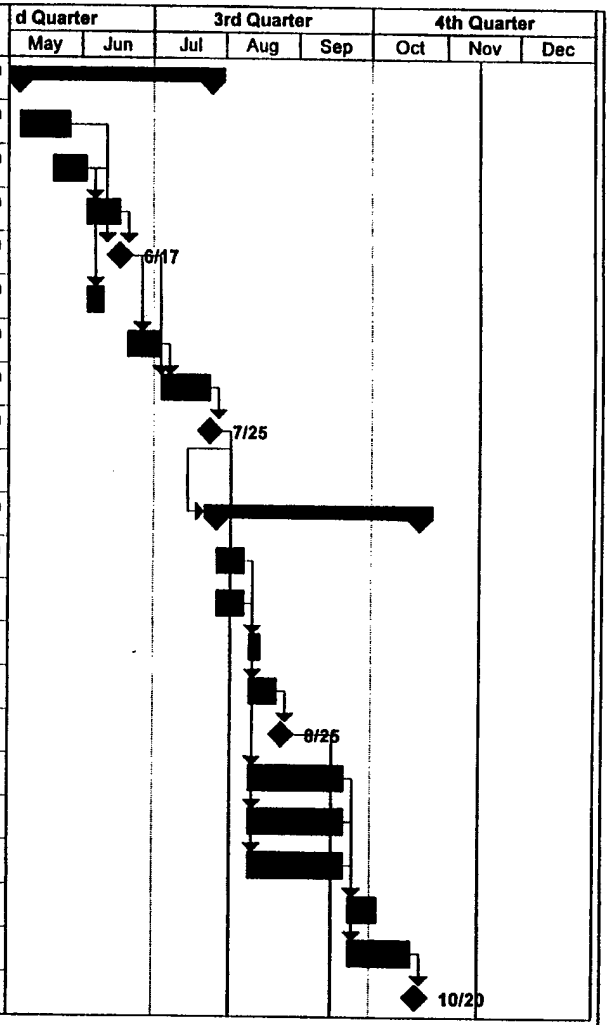
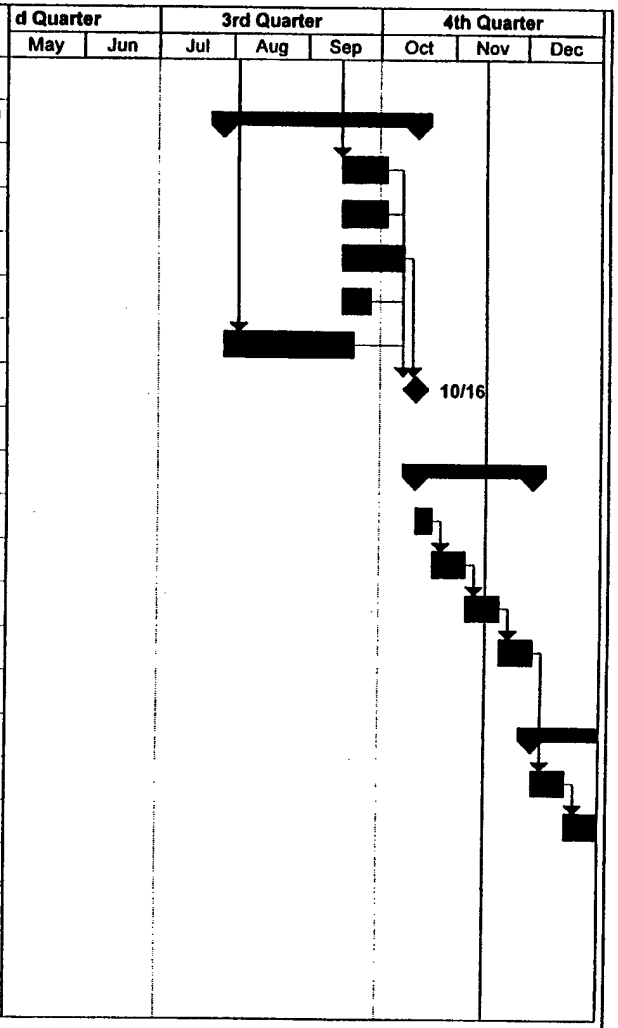
ID	Task Name	Duration	Start	Finish	% Comp.	Cost	Work
1	**Software Requirements An**	**59d**	**5/6/97**	**7/25/97**	**0%**	**$0.00**	**0h**
2	Examine Process Docu	15d	5/6/97	5/26/97	0%	$0.00	0h
3	Interview Key Personnel	10d	5/20/97	6/2/97	0%	$0.00	0h
4	Identify Automation Opp	10d	6/3/97	6/16/97	0%	$0.00	0h
5	Select Version 1 Candid	3d	6/17/97	6/19/97	0%	$0.00	0h
6	Develop Process model	5d	6/3/97	6/9/97	0%	$0.00	0h
7	Develop Data Flow Diagr	10d	6/20/97	7/3/97	0%	$0.00	0h
8	Prepare Softward Devel	15d	7/4/97	7/24/97	0%	$0.00	0h
9	SDP - Release 1.0	1d	7/25/97	7/25/97	0%	$0.00	0h
10							
11	**System Design Analysis**	**61d**	**7/28/97**	**10/20/97**	**0%**	**$0.00**	**0h**
12	Define System Architect	10d	7/28/97	8/8/97	0%	$0.00	0h
13	Define Legacy Interfaces	10d	7/28/97	8/8/97	0%	$0.00	0h
14	Define Database	5d	8/11/97	8/15/97	0%	$0.00	0h
15	Develop SRA - Release	10d	8/11/97	8/22/97	0%	$0.00	0h
16	SRA- Release 1	1d	8/25/97	8/25/97	0%	$0.00	0h
17	Define Screens	30d	8/11/97	9/19/97	0%	$0.00	0h
18	Define Reports	30d	8/11/97	9/19/97	0%	$0.00	0h
19	Define Processing Actio	30d	8/11/97	9/19/97	0%	$0.00	0h
20	Create Structure Charts	10d	9/22/97	10/3/97	0%	$0.00	0h
21	Prepare Design Docume	20d	9/22/97	10/17/97	0%	$0.00	0h
22	DDR-Release 1	1d	10/20/97	10/20/97	0%	$0.00	0h



Project: CONTRACT REQ-V1
Date: 11/14/97

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

ID	Task Name	Duration	Start	Finish	% Comp.	Cost	Work
23							
24	**System Development**	**59d**	**7/28/97**	**10/16/97**	**0%**	**$0.00**	**0h**
25	Develop Screens	15d	9/15/97	10/3/97	0%	$0.00	0h
26	Develop/Reuse Routing	15d	9/15/97	10/3/97	0%	$0.00	0h
27	Develop Reports	20d	9/15/97	10/10/97	0%	$0.00	0h
28	Develop Database	10d	9/15/97	9/26/97	0%	$0.00	0h
29	Develop SOW Template	40d	7/28/97	9/19/97	0%	$0.00	0h
30	Demonstrate system	1d	10/16/97	10/16/97	0%	$0.00	0h
31							
32	**System Testing**	**35d**	**10/16/97**	**12/3/97**	**0%**	**$0.00**	**0h**
33	Alpha Testing	5d	10/16/97	10/22/97	0%	$0.00	0h
34	Changes	10d	10/23/97	11/5/97	0%	$0.00	0h
35	Beta Testing	10d	11/6/97	11/19/97	0%	$0.00	0h
36	Perfective/Remedial Acti	10d	11/20/97	12/3/97	0%	$0.00	0h
37							
38	**System Production Implem**	**35d**	**12/4/97**	**1/21/98**	**0%**	**$0.00**	**0h**
39	ALC Implementation	10d	12/4/97	12/17/97	0%	$0.00	0h
40	APG Implementation	10d	12/18/97	12/31/97	0%	$0.00	0h
41	WSMR Implementation	5d	1/1/98	1/7/98	0%	$0.00	0h
42	Other Site Implementatio	10d	1/8/98	1/21/98	0%	$0.00	0h
43							
44	System Review and Next Acti	1d	1/8/98	1/8/98	0%	$0.00	0h



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Task
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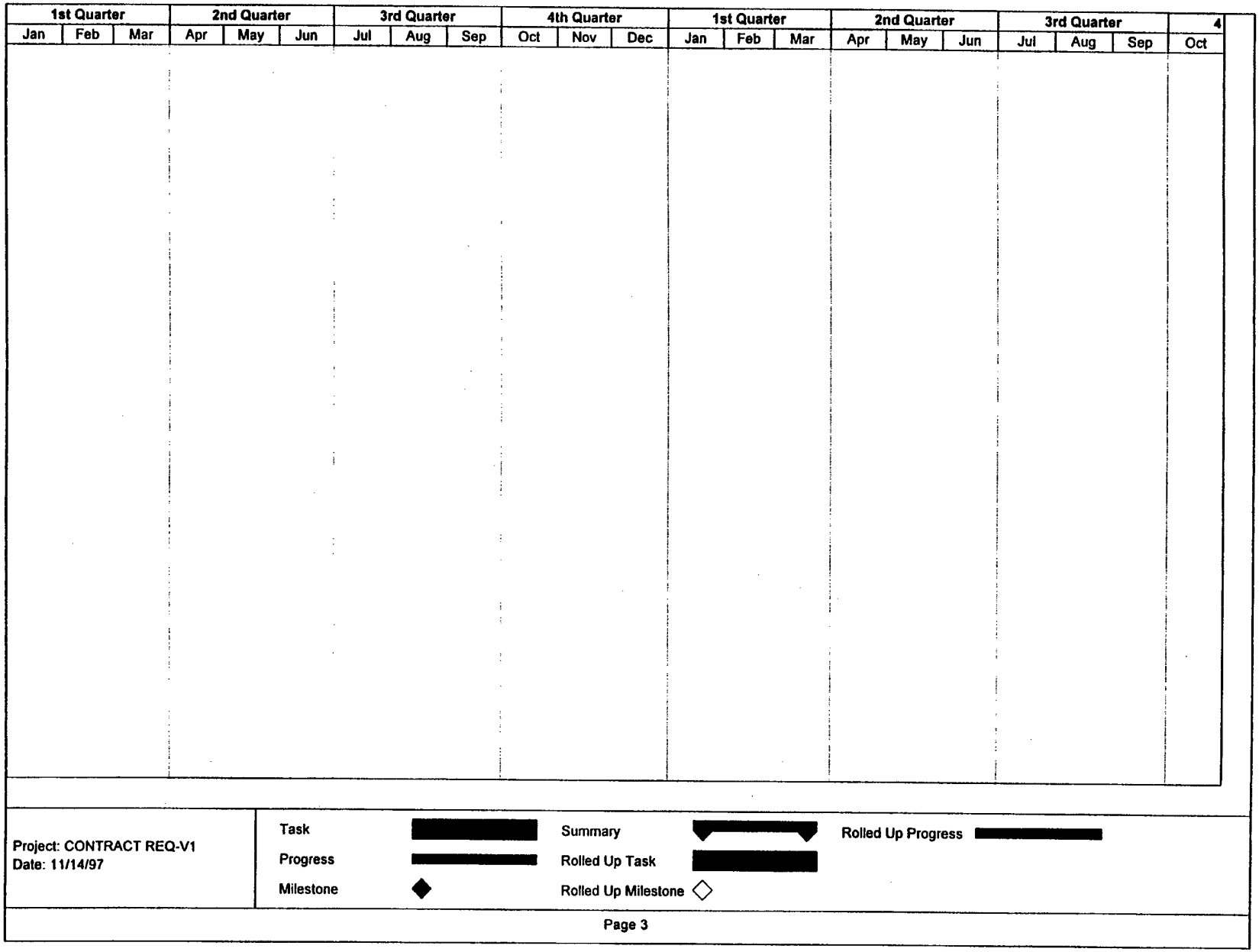
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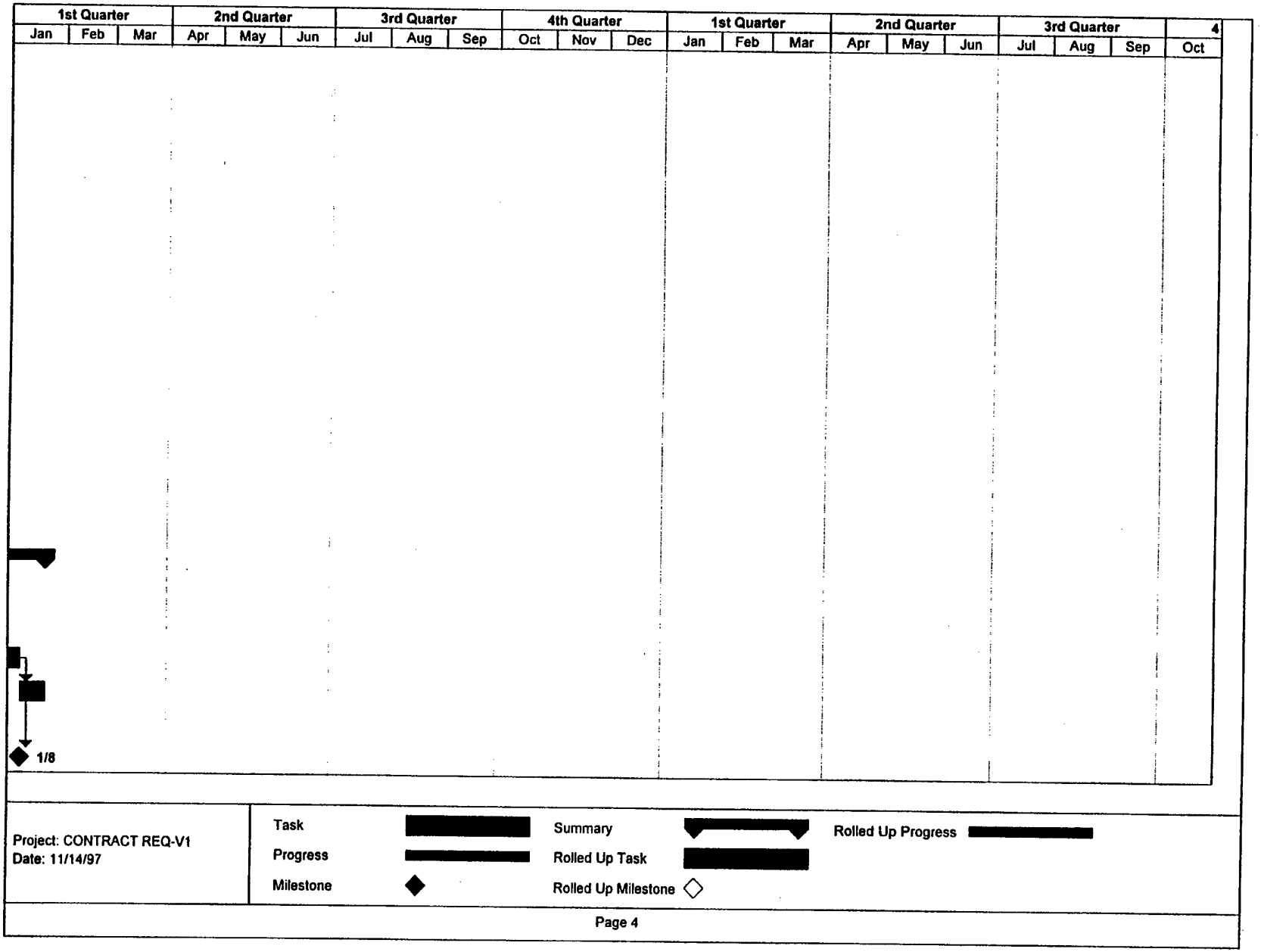
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13. ABSTRACT *(Maximum 200 words)*

This document is the first in a series of reports that make up the technical documentation library for Contract Request (Req) Version 1.0. Contract Req is a component of the Corporate Business Application Software System (C-BASS) suite of applications, an integrated family of Lotus Notes and Web-based software for U.S. Army Research Laboratory (ARL) electronic workflow and task automation. The purpose of Contact Req is to automate a portion of the ARL contracting process. This report contains five major segments: (1) Problem Statement, (2) Technical Approach, (3) Project Management Approach, (4) Product Assurance, and (5) Project Schedule. Together, these sections give an overview of Contract Req's purpose, identify organizational requirements and constraints, develop a management plan, and set forth a timetable with major milestones.

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